

Evaluation of Mortality Rates of Neodesha, Kansas—2002-2006



Kansas Department of Health & Environment

Office of Surveillance and Epidemiology
1000 SW Jackson St., Suite 210
Topeka, KS, 66612
1-877-427-7317
www.kdheks.gov/epi

Background

From 1898 through 1970 a petroleum refinery site was located in Neodesha, Kansas. The refinery was closed and dismantled in 1970. The site now consists primarily of commercial and industrial businesses; however, portions of the site are currently being used as a ballpark, an adult/child development disability center with a day care, and as an open space. According to the 2001 Kansas Annual Summary of Vital Statistics Report, Neodesha had the third highest five-year city death rate (1997-2001) in Kansas of 20.1 deaths per 1,000 people. Some citizens of Neodesha, Kansas are concerned that potential exposure to environmental contaminants from the site may be related to a high death rate in their city.

We conducted a mortality study of Neodesha, Kansas to analyze the death rate and to characterize causes of death.

Methods

Information for all deaths in Neodesha from 2002-2006 were obtained from the Kansas Department of Health and Environment's Office of Vital Statistics. Data was imported into a Microsoft® Excel spreadsheet.

Crude and cause-specific death rates for Neodesha were calculated. Age-adjusted death rates were calculated using the 2000 U.S. Census population standard and compared with age-adjusted death rates for Kansas as a whole. Mortality rates for all causes were calculated as deaths per 1,000 people. Disease-specific mortality rates (i.e. cancer, heart disease) were calculated as deaths per 100,000 people.

Results

When compared to the population of the entire state of Kansas, the city of Neodesha has a higher proportion of people over the age of 65 (Table 1). This includes 11% higher proportion of those aged 65-74 years, 42% higher proportion of those aged 75-84 years and 55% higher proportion of those aged 85 years of age or older.

Proportion of Population by Age Group, 2000

Table 1.

Age Groups	Neodesha		State of Kansas	
	Number	%	Number	%
0-4	190	6.7	188,708	7.0
5-14	477	16.7	399,592	14.9
15-24	350	12.3	400,285	14.9
25-34	321	11.3	348,853	13.0
35-44	410	14.4	420,351	15.6
45-54	334	11.7	354,149	13.1
55-64	203	7.1	220,253	8.2
65-74	206	7.2	175,916	6.5
75-84	236	8.3	128,543	4.8
85+	121	4.2	51,770	1.9
Total Population	2,848		2,688,420	

The crude death rate for Neodesha from 2002-2006 was 15.4 deaths per 1,000 population per year $[(220 / 14,240) * 1,000 = 15.4]$ (Table 2).

Crude Age-Specific Death Rates for Neodesha, 2002-2006

Table 2.

Age Group	Number of Deaths	Sum of Neodesha Population 2002-2006	Crude Age-Specific Death Rate (per 1,000)
0-4	3	950	3.16
5-14	2	2,385	0.84
15-24	2	1,750	1.14
25-34	4	1,605	2.42
35-44	5	2,050	2.44
45-54	14	1,670	8.38
55-64	16	1,015	15.76
65-74	28	1,030	27.18
75-84	63	1,180	53.4
85+	83	605	137.2
Total	220	14,240	15.4

However, in order to accurately compare the death rate to the entire state of Kansas we must take the age distribution of the population of Neodesha into consideration. This is accomplished by direct age-adjustment (Table 3).

Direct Age-Adjustment for Neodesha 2002-2006; All Causes of Death

Table 3.

Age Group	Neodesha Age-Specific Death Rate (per 1,000)	2000 U.S Population	Percentage of U.S Population by Age	Number Expected Deaths
0-4	3.16	19,175,798	7	60,555
5-14	0.84	41,077,577	15	34,447
15-24	1.14	39,183,891	14	44,782
25-34	2.42	39,891,724	14	99,419
35-44	2.44	45,148,527	16	110,118
45-54	8.38	37,677,952	13	315,863
55-64	15.76	24,274,684	9	382,655
65-74	27.18	18,390,986	7	499,949
75-84	53.4	12,361,180	4	659,961
85+	137.2	4,239,587	1	581,629
Total		281,421,906		2,789,378

The direct age-adjusted death rate for Neodesha is 9.9 deaths per 1,000 population per year $[(2,789,378 / 281,421,906) * 1,000]$.

We can now compare both the crude and age-adjusted death rate for Neodesha to the entire state of Kansas (Table 4).

Death Rate Comparison, 2002-2006

Table 4.

	Crude Death Rate* (95% CI)†	Age-Adjusted Death Rate* (95% CI)†
Neodesha	15.4 (13.4,17.4)	9.9 (8.6, 11.2)
Kansas	9.0 (8.95,9.05)	8.1 (8.06,8.15)

* Per 1,000 people

† 95% Confidence Interval

Indirect age-adjustment allows us to calculate the number of deaths that we would expect in Neodesha if the population in Neodesha were dying at the same rates by age as the state of Kansas. The end result is the expected number of deaths in Neodesha (Table 5).

Indirect Age-Adjustment for Neodesha 2002-2006; All Causes of Death

Table 5.

Age Group	Sum of Population 2002-2006	Kansas 2006 Age Specific Death Rates	Number Expected Deaths in Neodesha
0-4	950	0.0018	1.7
5-14	2,385	0.0002	0.48
15-24	1,750	0.0008	1.4
25-34	1,605	0.00101	1.62
35-44	2,050	0.0016	3.28
45-54	1,670	0.0046	7.68
55-64	1,015	0.0111	11.27
65-74	1,030	0.0208	21.42
75-84	1,180	0.0528	62.30
85+	605	0.1584	95.83
Total	14,240		206.98

We would expect 207 total deaths from 2002-2005 in Neodesha. The total expected deaths in Neodesha from 2002-2006 (n=207) are compared to the actual deaths (n=220) from the same time period. The standardized mortality ratio, or SMR, is the ratio of observed/expected deaths. The SMR is 1.06 (220/207). A ratio of approximately 1 indicates that the number of actual deaths equals that of the expected deaths. We are able to calculate an indirectly standardized death rate for Neodesha of 9.4 by multiplying the SMR (1.06) by the crude death rate for the state of Kansas (8.9).

Next we will examine the causes of death for Neodesha compared to the state of Kansas (Table 6).

Top Five Causes of Death, 2002-2006

Table 6.

	Neodesha		Kansas	
	Number	%	Number	%
1. Heart Disease	55	25.0	30,835	25.2
2. Cancer	32	14.5	26,648	21.8
3. Chronic Lower Respiratory Disease (CLRD)	20	9.1	7,160	5.9
4. Stroke	11	5.0	8,238	6.7
5. Diabetes	14	6.4	3,572	2.9

The top five causes of death in Neodesha are heart disease, cancer, chronic lower respiratory disease (CLRD), stroke and diabetes. This closely follows the top five causes of death in Kansas with the exception of stroke as the number three cause of death followed by CLRD. The proportion (percent) of disease-specific cause of death was determined by taking the number of deaths and dividing by the total deaths in all categories from 2002-2006 (Neodesha=220, Kansas=122,221).

In order to compare the disease-specific death rates between Neodesha and the entire state, we must perform the same calculations as we did for all causes of death. We will start with the number one cause of death in Neodesha, heart disease (Table 7).

Direct Age-Adjustment for Neodesha 2002-2006; Heart Disease

Table 7.

Age Group	Neodesha Age-Specific Death Rate (per 100,000)	2000 U.S Population	Percentage of U.S Population by Age	Number Expected Deaths
0-4	0	19,175,798	7	0
5-14	0	41,077,577	15	0
15-24	0	39,183,891	14	0
25-34	0	39,891,724	14	0
35-44	97.6	45,148,527	16	44,047
45-54	299.4	37,677,952	13	112,808
55-64	394.0	24,274,684	9	95,664
65-74	388.4	18,390,986	7	71,421
75-84	1,186.4	12,361,180	4	146,658
85+	4,297.5	4,239,587	1	182,197
Total		281,421,906		652,795

The direct age-adjusted death rate of heart disease in Neodesha is 232 deaths per 100,000 population per year $[(652,795 / 281,421,906) * 100,000]$. We can now compare this to the entire state of Kansas (Table 8.).

Heart Disease Death Rate Comparison, 2002-2006

Table 8.

	Crude Death Rate* (95% CI)†	Age-Adjusted Death Rate* (95% CI)†
Neodesha	385.0 (283,487)	232.0 (176,288)
Kansas	225.5 (223,228)	200.2 (198,202)

* Per 1,000 people

† 95% Confidence Interval

Initially, the crude death rate (385.0 per 100,000) for heart disease in Neodesha appears to be much higher than for the state of Kansas (225.5 per 100,000). Once we adjust for age, the death rate for Neodesha decreases to 232 per 100,000. Although this rate appears to be higher than the age-adjusted rate of 200.2 for Kansas, the 95% confidence interval (176, 288) encompasses the age-adjusted death rate for Kansas of 200.2.

Next we will perform the same calculations for cancer (Table 10).

Direct Age-Adjustment for Neodesha 2002-2006; Cancer

Table 10.

Age Group	Neodesha Age-Specific Death Rate (per 100,000)	2000 Kansas Population	Percentage of U.S. Population by Age	Number Expected Deaths
0-4	0	19,175,798	7	0
5-14	0	41,077,577	15	0
15-24	0	39,183,891	14	0
25-34	0	39,891,724	14	0
35-44	48.8	45,148,527	16	22,032
45-54	119.8	37,677,952	13	45,138
55-64	295.6	24,274,684	9	71,756
65-74	873.8	18,390,986	7	160,700
75-84	847.5	12,361,180	4	104,761
85+	1157	4,239,587	1	49,052
Total		281,421,906		453,439

The direct age-adjusted death rate of cancer for Neodesha is 161 deaths per 100,000 population per year $[(453,439 / 281,421,906) * 100,000]$. We can now compare this to the entire state of Kansas (Table 11).

Cancer Death Rate Comparison, 2002-2006

Table 11.

	Crude Death Rate* (95% CI)†	Age-Adjusted Death Rate* (95% CI)†
Neodesha	224 (146,302)	161 (108,226)
Kansas	195 (193,197)	184 (182,186)

* Per 1,000 people

† 95% Confidence Interval

Initially, the crude death rate (224 per 100,000) of cancer in Neodesha appears to be higher than for the state of Kansas (195 per 100,000). Once we adjust for age, the death rate for Neodesha decreases to 161 per 100,000. This is actually lower than the age-adjusted death rate for Kansas of 184 per 100,000.

Discussion

Mortality rates, or death rates, are often used as a measure of health status for a population. Many factors affect the risk of death, including age, race, gender, occupation, education, and income. By far the strongest of these factors affecting the risk of death is age. Populations often differ in age composition. A “young” population has a higher proportion of persons in the younger age groups, while an “older” population has a higher proportion in the older age groups. Therefore, it is important to control for differences among the age distributions of populations when making comparisons among death rates to assess the relative risk of death.

The city of Neodesha has a higher proportion of its population 65 years of age and older than the entire state of Kansas. Although the crude death rate for Neodesha (15.4 per 1,000) appears to be much higher than the entire state of Kansas (9.0 per 1,000), once we adjust for age, the death rate for Neodesha decreases to 9.9 per 1,000 and is much closer to the state at 8.1 per 1,000. The age-adjusted death rate for Neodesha is not encompassed in the 95% confidence interval for the age-adjusted death rate for Kansas. This may be due to the small number of deaths in Neodesha. Small numbers can increase the likelihood of random error.

In order to compensate for potential error due to the small number of deaths, we calculated an indirect age-adjusted death rate to determine the number of expected deaths in Neodesha if the population had the same age distribution as the state of Kansas. The total expected deaths in Neodesha from 2002-2006 (n=207) are compared to the actual deaths (n=220) from the same time period. The standardized mortality ratio is 1.06 (220/207). A ratio of approximately 1 indicates that the number of actual deaths equals that of the expected deaths.

The crude death rates for heart disease and cancer in Neodesha appeared much higher than the state. However, once adjusted for age, death rates for both decreased; the age-adjusted death rate for cancer in Neodesha is lower (168 per 100,000) than for the state (184 per 100,000). The age-adjusted death rate for heart disease in Neodesha is 232 per 100,000. Although this rate appears to be higher than the age-adjusted rate of 200.2 per 100,000 for Kansas, the 95% confidence interval (176, 288) encompasses the age-adjusted death rate for Kansas of 200.2. Therefore, we would not consider the difference between the two rates to be significant.

In conclusion, once adjusted for age, the death rates in Neodesha are similar to Kansas.